

AMENDMENTS TO THE CLAIMS

The listing of claims below replaces all prior versions, and listings, of claims:

1 1. (Original) A database system comprising:
2 one or more storage devices containing a table having plural rows,
3 the plural rows including a first row containing a before image
4 representing data before a data modification operation and a second row containing an
5 after image representing data processed by the data modification operation.

1 2. (Original) The database system of claim 1, wherein the one or more
2 storage devices further contain identifiers to identify a state of each row.

1 3. (Original) The database system of claim 2, wherein the identifiers are
2 contained in the table.

1 4. (Currently Amended) The database system of claim 1, wherein the first
2 and second rows are associated with ~~the same~~ one row identifier.

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1 5. (Original) The database system of claim 4, wherein the table further
2 contains state identifiers to identify a before image state of the first row and an after
3 image state of the second row.

1 6. (Original) The database system of claim 1, wherein the data modification
2 operation is performed in a transaction, the transaction having one or more requests,
3 wherein the first row contains a transaction before image representing data before the
4 beginning of the transaction, and wherein the plural rows further comprise a third row
5 containing a request before image representing data before the beginning of a request in
6 the transaction.

1 7. (Original) The database system of claim 5, further comprising a module
2 adapted to transition the state of each row based on a data manipulation command.

1 8. (Original) The database system of claim 1, further comprising a module
2 adapted to return data in the second row in response to a read request under a normal
3 condition.

1 9. (Original) The database system of claim 8, wherein the module is adapted
2 to return data in the first row in response to a read request under an abort condition in
3 which the modification operation is aborted.

1 10. (Original) The database system of claim 9, further comprising a rollback
2 module adapted to mark the first row as containing a current image in response to the
3 abort condition.

1 11. (Original) The database system of claim 10, wherein the rollback module
2 is adapted to further remove the second row in response to the abort condition.

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1 12. (Original) The database system of claim 1, wherein the table contains a
2 first row identifier associated with the first and second rows, a first state identifier having
3 a first value associated with the first row, and a second state identifier having a second
4 value associated with the second row.

1 13. (Original) The database system of claim 12, wherein the table further
2 contains a mutation identifier associated with the first row identifier to identify that the
3 modification operation is occurring with respect to one or more rows associated with the
4 first row identifier.

1 14. (Original) The database system of claim 13, wherein the mutation
2 identifier changes value with each new modification operation.

1 15. (Original) The database system of claim 14, wherein the data modification
2 operation is performed in a transaction, each transaction having one or more requests, the
3 mutation identifier having a transaction identifier portion and a request identifier portion.

1 16. (Original) The database system of claim 15, wherein the transaction
2 identifier portion has a value that increments with each new transaction.

1 17. (Currently Amended) The database system of claim 14, further comprising
2 a module adapted to return a row ~~to return~~ based on the mutation identifier and state
3 identifier information.

1 18. (Original) The database system of claim 14, wherein the one or more
2 storage devices further contain an active mutation identifier list having one or more
3 mutation identifiers associated with one or more active modification operations.

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1 19. (Original) The database system of claim 18, wherein the one or more
2 storage devices further contain an abort mutation identifier list having one or more
3 mutation identifiers associated with one or more aborts of modification operations.

1 20. (Original) A method of providing access in a database system, comprising:
2 storing data in rows of a table; and
3 in response to a data modification operation of a first row, marking the
4 first row as a before image row containing data before the start of the data modification
5 operation, and creating a second row as an after image containing data processed by the
6 data modification operation.

1 21. (Original) The method of claim 20, further comprising setting a first state
2 identifier to a first value to identify the first row as the before image row and setting a

3 second state identifier to a second value to identify the second row as the after image
4 row.

1 22. (Original) The method of claim 21, further comprising returning the
2 second row in response to a read operation under a first condition.

1 23. (Original) The method of claim 22, further comprising returning the first
2 row in response to the read operation under a second condition in which the data
3 modification operation has been aborted.

1 24. (Original) The method of claim 20, further comprising rolling back to the
2 first row if the data modification operation aborts.

1 25. (Original) The method of claim 24, further comprising deleting or marking
2 as available for reuse the second row during a rollback process in response to the abort.

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1 26. (Original) The method of claim 20, further comprising marking the second
2 row as a current row if the data modification operation commits.

1 27. (Original) The method of claim 26, further comprising deleting or marking
2 as available for reuse the first row once the data modification operation commits.

1 28. (Original) An article comprising at least one storage medium containing
2 instructions that when executed cause a system to:
3 store data in rows of a table; and
4 store a state identifier associated with each row, the state identifier having
5 a first value to indicate a row as being a before image of a data modification operation

6 and a second value to indicate a row as being an after image of a data modification
7 operation.

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1 29. (Original) An article comprising at least one storage medium containing:
2 a data structure having plural portions,
3 the data structure further containing state identifiers associated with
4 corresponding portions, a first state identifier having a first value to indicate a row as
5 being a before image of a data modification operation and a second state identifier having
6 a second value to indicate a row as being an after image of a data modification operation.

1 30. (New) The database system of claim 1, wherein the table comprises a
2 relational table for storing data of a database.

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1 31. (New) The database system of claim 1, further comprising:
2 plural storage elements to store the table; and
3 plural access module processors to enable parallel access of the plural
4 storage elements.

1 32. (New) The method of claim 20, wherein storing the data in rows of the
2 table comprises storing database data in rows of a relational table.

1 33. (New) The article of claim 28, wherein storing data in rows of the table
2 comprises storing database data in rows of a relational table.

1 34. (New) The article of claim 28, wherein the instructions when executed
2 cause the system to:
3 respond with data in a row containing an after image in response to a read
4 request under a normal operating condition; and
5 respond with data in a row containing a before image in response to a read
6 request under an abort condition.